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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :
B61B 13/00, B60F 1/00

A1

(11) International Publication Number: WO 91/18777

(43) Internati nal Publication Date: 12 December 1991 (12.12.91)

(21) International Application Number: PCT/DK91/00146

(22) International Filing Date: 30 May 1991 (30.05.91)

(30) Priority data:

1354/90	1 June 1990 (01.06.90)	DK
2314/90	25 September 1990 (25.09.90)	DK
2957/90	13 December 1990 (13.12.90)	DK
0168/91	31 January 1991 (31.01.91)	DK

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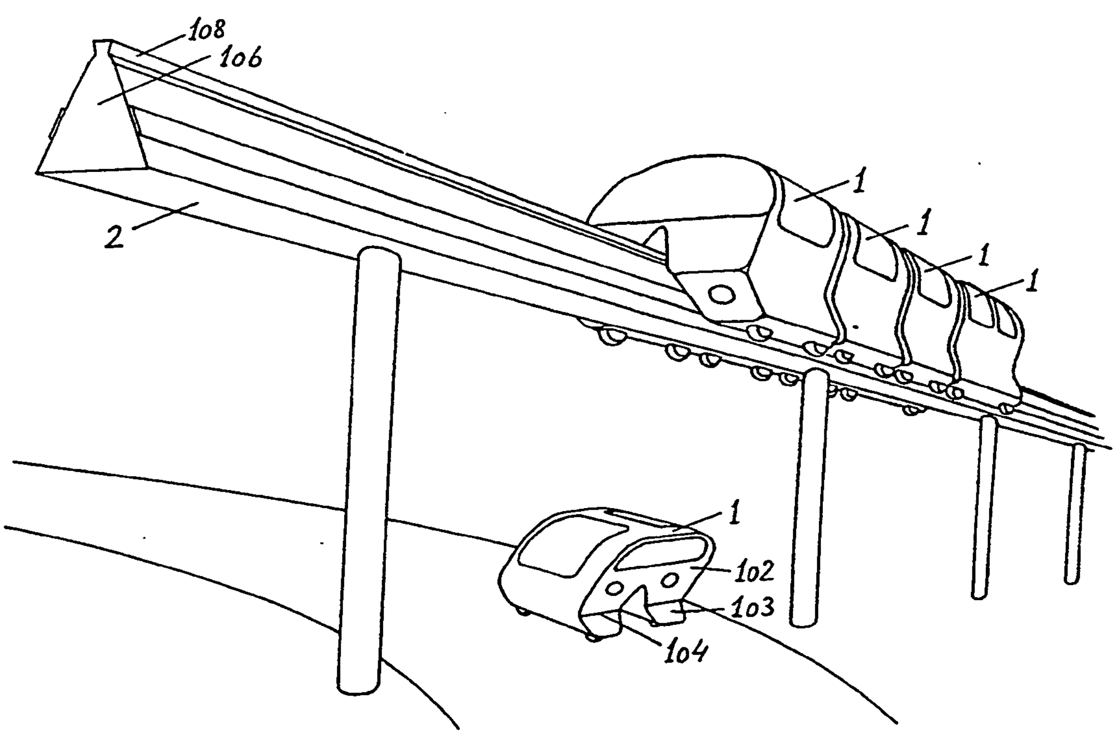
(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
In English translation (filed in Danish).

(54) Title: TRANSPORTSYSTEM



(57) Abstract

A transportsystem based upon small individual electric cars (1) which can drive on the normal roads but which also can drive on a triangular rail (2) where they can be coupled close together in rows.

TRANSPORTSYSTEM

The invention relates to a transportsystem which combines the advantages of an electric car with the advantages of a train.

BACKGROUND:

The modern big cities suffer from an increasing load of traffic, both as to pollution, noise and spacelimitation. The dynamic traffic of the city is both the basis of the city-society and its curse.

The collective trafficsystems as we know them today are no real alternative to the private automobile.

Waiting-time, the lack of geografic coverage and problems with damage are among the disadvantages of the systems.

Private car driving, as we know it today cannot continue.

Traffic accidents, pollution, the use of ressources, destruction of the city-environment, the lack of parking space are some of the problems of private car driving.

Known transportation-systems divide mainly into two "transport-cultures": the automobile-culture and the train-culture.

The automobile-culture which is the dominating in modern society is caracterized by an enormous flexibility. This is a very important aspect for the modern man, living an active and spontaneous life. The freedom that enables you to, anytime to place yourself behind the wheel and, whithout change of transportation-medium to reach any target placed along a road, is extremely important.

The train-culture is developed in a time where the

pressure of time was less, and where a travel was something you planned. By planning the voyage in relation to the timetable of the train, the traveler obtains the very pleasent effect that she does not have to control the vehicle, but she can relax and be sure that the train is one of the safest ways to be transported.

This separation between traffic-cultures has been caracteristic for the last more than 40 years. The situation however is about to change on important points.

Society does no longer accept the enormous amount of traffic accidents caused by the private cars.

The environment can no longer cope with the amount of pollution and carbondioxide from the transportation-sector.

The big cities are about to be congested in the number of car-commuters and their parked cars.

At the same time, flexibility is a still more inportant factor of the dynamic of the society.

THE PURPOSE OF THE INVENTION

The purpose of the RUF- (or TAC-) traffic-concept is to create an alternative system with advantages from both systems.

THE ELEMENTS OF THE INVENTION:

By means of some new elements I have succeded to create solutions to some of the pressing traffic problems. Among these new elements could be mentioned:

*) The RUF has both wheels for the rail and ordinary car-wheels.

*) The notch along the cabin of the RUF allowes it to

ride very stable on a triangular rail.

*) Rail-switch is obtained by simply letting the triangular rail dissappear in the road and the RUF continue as a car on a piece of road where a choice of rail or road can be made.

*) The cabine of the RUF allowes close coupling in a row.

*) Mechanical coupling gives both a flexible coupling during rail-driving, and the possibility of trailer-driving on normal road.

*) A controlsystem based upon the Doppler ultrasonic principle gives a reliable measurement of distances and relative velocities.

*) Rear light with chopped pulsed light gives safe indication of relative velocity.

*) An effective rail-brake make brake-linings unnecessary on the rail-wheels. Low noise and rolling resistance is the consequence.

*) The RUF collects current from the rail in order to recharge the batteries during rail-driving.

*) Magnetic cards (creditcards) are used for opening the RUF. You dont have to buy a ticket. Damage is prevented.

*) Side-guidance in the switch-area makes it possible to obtain automatic switching of driverless containers for goods. "Just In Time" transportation can be obtained.

*) Sequential switching of the current-rail enables syncronization of the RUFs before merging.

*) Multiple gliding-contacts enables the RUF to "ride" on a "current-wave"

*) Safe entrance to the rail is obtained by guidance rollers at the start of the rail.

*) A Moiree-pattern at the start of a rail helps the driver to hit the rail correctly.

*) A Mat made of Nylon accelerates the wheels before the RUF leaves the rail and continue on the road.

*) Battery-terminal system allows very fast change of batteries.

*) A programmable barcode allows transfer of data from the RUF to the main control-system during driving.

*) Parking-rail enables a very effective parking.

*) Superconductive rail in a vacuum-tube makes it possible to create a very fast train-system.

KNOWN TECHNIQUE

A transportation-system operating in "Dual mode", that is which can function both as a rail unit and as an individual car, is known from U.S. patent 4,791,871. It describes a three wheeled cabine hanging under a rail shaped as a tube.

The suggested solution offers very limited advantages, but a number of disadvantages. It is still a concept with units driving at a certain distance to the other units. In this way the air resistance is not reduced. The rolling resistance is not significantly reduced either since the wheels still have brake linings. The switch from road driving to rail driving is complicated and the shape of the cabine is very diverging from normal shapes.

The RUF-system is built around a small electric car, an a very simple and light triangular rail.

The invention will in the following be described by means of the following figures:

Fig. 1 showes the two "modes" of the RUF-system. The RUF (1) can either drive quite normal on the road together with other cars, or on a triangular rail (2), either alone or as shown in a row. The cabine of the RUF is characterized by that the front and rear consists of two planes (102) and (103) intersecting along a horizontal line (104). The cross section of the rail (106) is mainly triangular, but in the top it is supplied with a special braking rail.

Fig. 2 shows how the RUFs (1) can leave the rail (2) simply by letting the rail flatten out and become a road (48). Ahead of this point, the units can be separated as shown, but they can also leave the rail while they are coupled together. The figure shows the characteristic notch (105) along the cabine.

Fig. 3 shows a crosssection through the RUF-cabine seen from the side. The length of the cabine can vary, but the shape of the front (100) and the rear (101) is mainly the same and common to all RUFs. The shape is characteristic by having a notch (3) with an angle of approximately 90 degrees. This makes the rear (101) a perfect reflector for either radar- or sound-waves emitted from the RUF driving behind. The angle may have another size if the surface of the rear is made up of small reflectors (small inverted cube-corners).
The batteries (4) are placed as low as possible in order to lower the center of gravity. The motor (5) has ordinary belt drive to the central rail-wheel (6) and to the rear-wheels (7). The gearing is different to the two drive systems. The rail-wheel (6) rotates for example 3 times as fast as the rear-wheel (7). The speed on the rail can this way become 3 times as big (200

km/h) as on the road.
The steering-wheel (8) is coupled to the front-wheels (41) by means of a system (9) which binds together the movements of the front-wheels over the notch (10) running along the central part of the cabin.
The central rail-wheel (6) can be supplemented by a corresponding wheel (12) (without driving power) placed in the front part of the cabin.
Fig. 4 shows the cabin and the rail seen from behind in crosssection.
The batteries (4) are placed as low as possible and on each side of the notch. If only one battery is used, it is placed in the right side because of the center of gravity, since there always is a driver seated in the left side. The motor can be doupled. If there is only one, it should also be situated in the right side. The central rail-wheel (6) rests on top of the top-profile (11) of the triangular rail. The wheel is a smooth rubber-wheel without brake linings. On each side of the rail-wheel is seen some ordinary coupling-elements (18) connecting the two rear-wheels (7) in a way that allows them to rotate with different speed during a turn on ordinary road. On the sides of the triangular rail, a number of support-wheels (13) and (14) are rolling partly on the sides of the topprofile (11), partly on a pair of longitudinally rails (15) placed some distance down the sides of the rail (but not all the way down). These support-wheels supports the RUF both in the front and the rear.
The RUF-cabin is on the sides (16) towards the rail covered with sound-absorbing material and the lower support-wheels (14) are placed at a small distance from the slit (17) between the rail and the RUF. Hereby the minimal noise from the wheels is further dampened and

very little noise escapes to the surroundings.
The rail is built around a lattice mast with three lengthwise tubes (19). The upper tube is connected to the special top-rail-profile (11). The sides and the bottom of the rail is covered by wheather resistant plates (20). The sides can be covered by solar cells which can directly contribute to the powersupply of the system. Current-rails (21) on the sides of the triangular rail supplies the RUF with current via sliding contacts (22).
Fig. 5 shows the special rail-brake which squezzes directly around the top of the rail profile. The topprofile (11) is supplied with a smooth plane top-side (23) on which the central rail-wheel (6) rools with minimum rolling resistance and noise. the upper part of the sides (24) is tilting a bit inwards while the lower part (25) is tilting less than the sideplates (20) of the rail.
The upper part (24) of the top-profile (11) can squeezed by a pair of powerful braking-shoes (26) which by ordinary means canbe supplied with a very powerful braking-grip around the sides of the top-profile. The braking-shoes (26) which can be multiple are firmly connected to the chassis of the RUF in a place behind a vertical line through the center of gravity of the RUF. This ensures a very stable braking action. The use of tilting planes (24) ensures that the braking-grip cannot slip upwards. The placing of the braking-place exactly below or below and close behind the rear central rail-wheel (6) ensures an optimum braking action. A rail-brake of this kind cannot lock !!!
Fig. 6 and 7 showes an alternative construction of the rail-brake. Instead of braking-shoes acting directly on the rail-profile it uses braking wheels (27) on which

an ordinary disk-brake delivers the braking-effect. By letting the axis (28) of the braking wheels have a slight tilting forwards in the direction of movement as shown in fig. 7, it is obtained that the wheels during braking makes the RUF stick to the rail.

Fig. 8 shows one of the security systems which are used to control the coupling and the switching.
The rear lights (29) are not ordinary lamps but bundles of light emitting diodes transmitting pulsed light by a pulse frequency F1 common to all RUFs (for example 100 kHz). The light from the light emitting diodes is monocromatic and with the same colour. The colour can advantageously be red, since the rear lights then can have the same function on normal roads as the ordinary car rear lights, that is to indicate braking acting by increased light intensity.
By rail driving (and where two RUFs are driving after eachother on the street) the front RUF transmits pulsed light directly to the rear. The light is also pulsed by a lower frequency F2 which is directly controlled by the speed of the RUF on the rail. This can for example be obtained by directly chopping the light by letting it through a disk (30) with alternate transparent and non-transparent segments. The disk rolles directly on the rail or the rail-wheel.
The RUF behind collects the douple pulsed light through a filter window (31) which excludes all other colours than corresponding to the light emitting diodes. A photocell (32) recieves the light and transforms it to an electric signal which is sent through a bandpassfilter (33) which only allows signals whith a frequency F1 (the fastest pulse) to pass. The resulting signal is detected and the frequency F2 is compared with

the RUF's own slow pulse F2' in a comparator (34). The difference between F2 and F2' is an expression of that the two RUFs are driving at different speed.

Fig. 9 is a blockdiagram showing the signal-flow in the system when the slow pulse is made via a logical element (35) supplying the light diode bundle (111).

Fig. 10 shows how a chopper disk (30) rolling directly on the rail (2) produces the slow pulse.

Fig. 11 shows how the caracteristic notch (3) of the RUF in the rear (101) works as a perfect reflectorfor a wavwtrain (36) which is transmitted from a front-end of a RUF and with the same direction as the rail.
The wavetrain which can consist of either soundwaves or electromagnetic waves (radar) hits the rear end of the RUF in front and is reflected back in the same direction and recieved by the RUF that transmitted the wavetrain. The rear can be divided into two planes corresponding to right side and left side. Between the two planes there can be a small angle. This will improve the reflection in case of a turning rail.
A wavetrain of ultrasound of for example 40 kHz and with a duration of 1 msek will consist of 40 oscillations propagating with a speed of 330 m/sec. The wavetrain will have a length of 33 cm and will after a reflection from a RUF at a distance of 5 m get back after a delay of 30 msec. A measurement of this time delay gives a measure of the distance between the RUFs.
By transmitting a longer wavetrain and comparing the phase of the transmitted and the recieved signal, the relative velocity of the RUFs can be calculated.
At longer distances (more than 10 m) radar pulses can

give a measure of the distance between the RUFs. Radarpulses reflects in the same as ultrasoundpulses but the time delays are much shorter.

Fig. 12 shows a coupling system between RUFs in a row. The coupling system consists of two telescopic arms (37) (which in the figure is shown in their extended state), and a head (38) which is coupled flexible to the telescope arms. The head (38) fits into a fixture (39) sitting in the middle of the rear side (101) of the RUF directly above the rail (2). In case of contact the head (38) is fixed by means of a combination of magnetic means and mechanical lock a limited holding power.
When the telescope arms are folded together, they are placed inside the cabin of the RUF on each side of the front central rail-wheel (12). The head (38) disappeares in a hole in the front end (100) of the RUF and is aligned with the surface of the cabin. The telescope arms (37) are unfolded in ample time before a coupling takes place and makes shure that the last part of the coupling action is performed quietly. In case of a failure in the controlsystems the telescope arms will act as bumpers (pneumatic) to avoid hard bumps. By decoupling from a row the telescopesystem also takes care of the first critical part. The system remains unfolded for safetyreasons as long as there remains a short distance to the RUF in front.
The very first RUF in a high-speed-row can also advantageously have the telescopesystem unfolded. In case of a bird sitting on the top of the rail, this will be removed without hurting the RUF-row.
By means of the shown security-systems it is possible to make couplings and decouplings dynamically, that is during raildriving. This gives a very big flexibility

in the traffic flow and consequencely a high real velocity.

Fig. 13 shows the simplest form of a switch where the RUFs can change rail, leave or enter the rail system. The rails (2) simply disappears by lowering to road level and "flatten out" (or by raising the road to rail level and at the same time let the rail disappear).

Fig. 14 shows how a mat of for example Nylon or another hard-wearing and flexible material contribute to accelerate the wheels (7) and (41) before they touch the road (42). The mat is placed imidiatly in front of the point (110) where the wheels are touching the road.

Fig. 15 shows how it is possible to secure that the RUF always hits a rail correctly.
On each side of the starting point of the rail (43) is placed a conical roll (44) which rotates in such a way that if one of the front wheels (41) hits it, the wheel will be forced to the correct position before it is too late. The other front wheel will be placed on a free-rolling roll (45) which helps it to get right on track. The axis (112) of the free-rolling rolls, are two by two parallel to the lines (113) where the conical rolls are cutting the plane of the road closest to the rail. The distance between the rolls (44) and (45) which belongs together, corresponds to the distance between the wheels.
Since all RUFs have the same width it is furthermore possible to place side-rolls (46) affecting the sides if a RUF hits the rail in a wrong angle. The side-rolls can be passive free-rolling rolls or rotate at an appropriate speed.

Fig. 16 shows an example of a switch-place where several functions are combined.

At the bottom of the figure it is shown how two rails disappear (47 and 48) and the RUF-flows from them are merged together on a piece of road (49) surrounded by rail-guides (50) on each side. Ahead of this point, the RUFs are separated and syncronized for example by means of the method given in fig. 19.

On the upper part of the figure is shown how one can choose between three possibilities: rail to the right, rail to the left or road straight ahead.

Fig. 17 and 18 shows more in detail how the side guidance can be realized. Fig. 18 is a detail of fig. 17 seen along left side of the RUF.

On the sides of the RUF is placed side-lights (51) which partly can be used in the normal way to indicate a turn when the RUF is driving on the normal road, partly to activate the side-guidance-system in a switch-place. The light from the side-light (monocromatic pulsed light from light emitting diodes) activates a photocell (52) in each of the roller-columns (53), thereby creating a current in the coil (54) which creates a magnetic field in the rotating iron-core (55) which in turn attracts the ironplate (56) which is placed on the side of the RUF at the same height as the iron-core. The iron-cores (55) are put into rotation by a lengthwise rubberbelt (57) which is moved by one or more driving rolls (58) and is kept suspended by one or more spring activated rolls (59). The magnet rolls (55) consist of two disk-shaped rolls connected with an axial cylindrical piece (115).

In order to establish safe contact with the magnetic rolls (55) the system can be supplied with horizontal rolls (60) in the road. Activated by sidelights (51)

these two rolls will force the RUF to contact with the relevant side where the magnet rolls (55) will sustain the grip of the RUF until it is safely positioned on the new rail.

At the same time activation of the sidelight causes the frontwheels to take the correct position in order to avoid unnecessary bumps.

Fig. 19 shows how the two parallel rails (116 and 117) are running imidiatly before the switchingplace.

On this part of the rail, the current rail (21) is divided into a row of segments (61) which are supplied with current in a special way such that only a group (62) of segments are active while the others are without current. The active group is made to built a wave that rolls along the rail by turning off the rear segment and turning on the new segment in front of the group. By doing this in a certain rate it is obtained that the current waves in the two rails roll 180 degrees out of phase. Since the RUFs (118, 119 and 120) drives by means of current from the rails, they will be forced into a fixed rytm and consequently they cannot collide when they merge. If every group for example consists of 10 segments each with a length of 20 cm and there are 30 segments between the groups without current, then this means that the RUFs will be forced to drive syncronously with a distance of 8 meters inbetween. If the segments are shifted in the group 50 times per second this will correspond to that the wave rolls 10 m/sec or 36.6 km/h. This can easily be implemented by using alternate current and shift during the zero crossing. This will minimize the shifting effects.

Fig. 20 shows a more advanced version where the segments (63) are separated by oblique spaces (121). This causes

the sliding contacts (22) to glide more easily and quiet from one segment to the other.
The wave function can be further improved by assigning different voltages (64) to the segments, for example exponentially increasing backwards. ARUF which is a little behind compared to the wave will now be accelerated strongly and very fast take its correct place on the wave.

Fig. 21 shows how the gliding contacts (22) can be multiple.
By assigning different significance to the gliding contacts in such a way that for example the first one (65) contributes most to the power of the motor it is also possible to improve the wave action.

Fig. 22 shows how the gliding contacts (22) ard the current rails (21) are placed.
The supply of current to the current rail can be balanced in such a way that it is undangerous to touch one of the current rails even though you are grounded. Only if you touch both the current rails at the same time you will get current through yourself.

Fig. 23 shows a special arrangement which makes it possible to balance the RUF in such a way that its center of gravity always lies close to the vertical center-plane along the rail. By making part of the battery capacity moveable in modules (66), a substantial shift of weight between the sides is possible. The battery modules of for example 10, 10 and 20 kg can realize weight-shifts of 40, 20, 0, -20 and -40 kg. The modules are hanging in spring-loaded forks (67) which can swing the modules over the central notch, around a

horizontal axis (125) and down on the other side. The modules are placed on top of the ordinary batteries (4). Fig. 24,25 and 26 shows an especially appropriate construction of the batteries and their mounting. The batteries (4) in the right and the left side are identical. They are equipped with vertical holes (68) with an elliptical crossection. The terminals (only shown on fig. 26) are each constructed as two electrodes (69) placed opposite and along the part of the elliptical hole with the smallest curvature (largest radius of curvature). The electrical connection is established by means of two contact-bars (70) which are hanging isolated in two bearing-holes (71) in the chassis of the RUF. The contact-bars (70) also have an elliptical crosssection, but in such a way that the central part (72) is removed to give room for a number of springs. The dimensions are chosen in such a way that the contact-bars (70) are completely separated from the surfaces of the elliptical holes (68) in a certain position. If the contact-bars are turned 90 degrees away from this position, the contact-bars (70) will have a reliable contact with the terminals (69) along its entire length.
At the bottom of the contact-bars (70) there can be a ledge (73) preventing the battery (4) to slide downwards. The contact-bars (70) can be supplied with a number of vertical contact-blades which further improves the electrical contact.

Fig. 27 shows how this type of battery-mounting makes it possible to perform a very fast "refueling" by changing the batteries in a special "accu-automaton". The RUF (1) drives to the automaton (74) where you via for example a credit card activates it. The batteries

are now "dumped" through the bottom (122) of the RUF via a pair of doors (75) in the road down to an undergroung recharging-place. The batteries (4) are released from the RUF by turning the contact-bars (70) 90 degrees. On the recharging-place, the batteries are lowered to a similar pair of contact-bars pointing vertically upwards. These are now turned 90 degrees and the recharging can start. At the same time a fully charged battery is moved to a position just below the RUF and raised to the correct height whereafter the contact-bars are rotated back to the position where there is electrical contact and where the batteries are fixed. This operation can be performed in less than 20 seconds. The battery-holes (68) can be of different size to prevent wrong mounting of the batteries.

Fig. 28 shows how the rail (2) advantageously can be mounted on the pillars (76).
A strong wire (77) is suspended between the pillars (76) and evenly spaced on this some support-wires (78) are fastened and carriing the lower part of the rail in the points (109). Some places the strong wire can be connected as a oblique wire (79) connecting to the base of the next pillar. This gives a very effective stiffening in the longitudinal direction which can be useful in case of the emergency-braking of a long fast moving RUF-row.

Fig. 29 shows how the support-wires (78) are fastened to the longitudinal tubes (19) of the "internal lattice mast". This way of support gives a very even top-rail (23) and consequently a very pleasant driving.

Fig. 30 shows a special parking-rail (80) which can be

used by the part of the RUFs who are collectively owened.

The rail is placed at a low height such that it is possible to alight directly from the rail. The rail can have a slight inclination making the RUF automatically roll forward to an endstop when the first one leaves the rail. The rail is only supplied with current on the part of the rail covered by a RUF, such that it can be recharged without risk to the surroundings.

When leaving a RUF you just drive it to the back of the row and leaves it there. When you need a RUF, you take the first one in the row. You open the RUF by using a credit card. This ensures that it is not damaged and at the same time the payment for the tour can be made via the credit card system.

Fig. 31 shows how a reader (81) to a magnetic card (123) can be placed.

Persons without a credit card who would like to rent a RUF, can buy a socalled "smart card" which is a card with a certain amount of money loaded into it. This amount is now the maximum amount that you can drive for.

Fig. 32 shows a system to read data from the computer of the RUF.

The barcode is twofold. The first part (82) is fixed and showes the identification-number of the RUF. The second part (83) er built by LCD-segments (84) and can be programmed to show the amount of money to transfer from the relevant account. The barcode is placed on the inner side (16) of the notch in the RUF in such a way that it can be read by means of a laser-beam emitting from the rail and reading the barcode while the RUF passes by. The reading-place can be at a short distance before leaving the rail.

Fig. 33 shows a system for transmitting signals between the RUF (1) and the rail (2).
Two wire-loops (85) are placed under the RUF close by the central notch and exactly opposite. In the bottom of the rail is a system of wires (86) creating a magnetic field with field-lines crossing the wire-loops (85). By using a fast pulsating magnetic field, a corresponding voltage will be induced in the wire-loops (85). Thi voltage can be used to communicate between the rail and the RUF. If a DC component of current is superposed onto the current in the rail-wires (86) it can be obtained that the magnet field in the RUF changes direction when it passes the crossing rail-wires (86). The crossings (124) can be ordered in a pattern creating a code containing for example the geographical position ("mile-stone") or it can be controlling the velocity at the specific place.

Fig. 34 shows the same wire-loops (85) in the RUF used in a situation where the RUF drives on a normal road. In the road there can be buried a system of parallel wires (87) creating a high-frequency magnetic field (88) around them. This field induces voltages into the two wire-loops (85). By comparing the amplitudes of the two voltages, it can be measured whether the position of the RUF on the road is correct. This system can be used both in the switch situation and on ordinary road.

Fig. 35 shows a new way of organizing a station by means of the RUF system. Here it is only the rail part of the RUF which is used.
At the top is shown the order (89) of stations from A to for example q. Some stations are big: A,E,M and P

while the rest are small. At the bottom is shown as an example how one of the big stations (E) is organized. Only the one direction is shown.

The RUF-rows are arriving at the switch-place (90) and the individual RUFs continue straight ahead while the RUF-train turns to the station. The order of the RUFs is such, that those heading for station E are situated in the back of the row. They leave the train at the platform (91) while those who are heading further automatically are channeled to the platforms (92) dedicated for their destination. The empty RUFs are used for those passengers who enter the system and continue.

When the number of RUFs ready to continue has become big enough, they will leave by building a new row at the departure-rail (93). The order is such that those heading for the first station (f) are in the back of the row. This has the consequence that when the row arrives at the switch-place before station f the f-RUFs will be decoupled while the rest of the row continues together.

This way several advantages are obtained:

The passengers don't have to worry about when to get off! The RUF they are entering drives automatically to the station corresponding to the platform they have chosen.

The speed of the system will be maximized, since there are fewer stops.

The departures are very frequent since the rows are relatively short.

The rail-system is the same as is used for the true RUF-system (the individual electric cars).

Fig. 36 shows a future version of the RUF-rail concept. A triangular rail (2) is filled with liquid nitrogen (99). The surface of the rail is made of a material which is superconductive at the temperature of liquid

nitrogen. The RUF-like cabin (94) is supplied with magnets (95) which makes the cabin float above the superconductive rail. The whole system is contained in a closed tube (96) which is evacuated. This eliminates the airresistance and reduces the heat-flow to the superconductor. The cabin is propelled (and braked) by means of a linear motor (97) and the speed can because of the lack of friction to air and rail be extremely high (more than 10.000 km/h).
The tube can be supplied with oblong windows (98).

CLAIMS

1. A transport system of the dual-mode type consisting of small individual electric cars (1) which both can drive on ordinary road and as a rail-vehicle with current from the rail (2) c h a r a c t e r i z e d b y that the units (1) can be coupled close together in a row such that the air resistance is decreased and the capacity of the rail increased.

2. Transport system according to claim 1, c h a r a c t e r i z e d b y that the front of the electric car (100) and the rear (101) has a shape which by coupling together gives the row of vehicles an almost unbroken surface.

3. Transportsystem according to claim 2, c h a r a c t e r i z e d b y that the front (100) and rear (101) of the electric cars are shaped as mainly two plane surfaces (102) and (103) intersecting in a horizontal line (104) and which creates an angle of 90 degrees.

4. Transportsystem according to claim 2, c h a r a c t e r i z e d b y that the rear (101) and maybe the front (100) is shaped as two seats of plate each consisting of two plates intersecting in a horizontal line with an angle of 90 degrees and where the intersecting-lines of the plate-seats are creating a small angle.

5. Transportsystem according to claim 1, c h a r a c t e r i z e d b y that the electric car (1) has a longitudinally notch (105) with a shape mainly identical to the crossection of the rail.

6. Transportsystem according to claim 5, c h a r a c t e r iz e d b y that the rail (2) is a structure with a mainly triangular crossection (106).

7. Transportsystem according to claim 5, c h a r a c t e r i z e d by that the electric car (1) switches from rail-driving to road-driving by lowering

the rail such that it disappears in the road whereby the ordinary road-wheels of the electric car takes contact with the road (107).

8. Transportsystem according to claim 5, c h a r a c t e r i z e d b y that the top af the rail is equipped with a braking-rail (108) which the braking system of the car can grip.

9. Rail-construction for transportsystem according to claim 8, c h a r a c t e r i z e d by, that the braking-rail in the top has two plane sides (24) with a slight tilt inwards in such a way that their prolongings would intersect vertically below the top of the rail.

10. Railconstruction according to claim 8 or 9 c h a r a c t e r i z e d b y that the top of the braking-rail (23) is a horizontal plane.

11. Railconstruction according to claim 6 c h a r a c t e r i z e d b y that the rail (2) is hanging in a wire-system which is suspended between pillars (76) and which is completely covered by the side-plates (20) of the rail.

12. Railconstruction according to claim 11, c h a r a c t e r i z e d b y that the rail (2) is carried by two sets of vertical wires (78) who are connected to the lower edge-tube (109) at even spaced positions and who at the top are attached to two strong longitudinally wires (77) resting on top of the pillars

(76).

13. Device for "mode"-shift according to claim 7, c h a r a c t e r i z e d b y that the road (42) in the area just before the point where the road-wheels contacts the road, is covered by a mat (40) made by a hard-wearing material (for example Nylon) consisting of long hairs.

14. Dualmode-vehicle according to claim 1, c h a r a c t e r i z e d b y that the vehicle is supplied with a coupling-unit (37 and 38) which can couple together with a corresponding coupling-unit (39) on the rear (101) of the vehicle driving in front of the first vehicle.

15. Coupling-unit according to claim 14, c h a r a c t e r i z e d b y that it contains at least one telescopic tube (37) which can be ejected from the front (100) of the vehicle.

16. Coupling-unit according to claim 14 or 15, c h a r a c t e r i z e d b y that the front part consists of a unit (38) which has the same slope in front as the slope of the rear of the vehicle in the same height.

17. Coupling-unit according to claim 16, c h a r a c t e r i z e d b y that the front part (38) by means of magnetical and/or mechanichal means can be hold flexible to the rear (101) of the vehicle ahead and with a limited force.

18. Coupling-unit according to claim 15,

c h a r a c t e r i z e d b y that the telescopic tube(s) /37) is shaped in such a way that a compression will compress the air in the tubes from which it can only escape via a small hole.

19. Controlsystem for transportsystem according to claim 3 or 4, c h a r a c t e r i z e d by, that a radarpulse transmitted from the vehicle is reflected by the 90 degrees reflector-rear (101) of the front-vehicle and used by known means to calculate the distance between the vehicles.

20. Controlsystem for transportsystem according to claim 3 or 4, c h a r a c t e r i z e d by, that an ultrasonic wave, transmitted by the vehicle is reflected by the 90 degrees reflector-rear (101) og the front-vehicle and used by means of the Doppler-principle and the puls-echo principle to calculate the relative speed and the distance of the front vehicle.

21. Controlsystem for transportsystem according to claim 1, c h a r a c t e r i z e d b y that the units are equipped with one or more rear-lights (29) transmitting light which is modulated with a signal that depends directly of the speed of the unit.

22. Rear-lights according to claim 21, c h a r a c t e r i z e d b y that the light is transmitted from lightemitting diodes (111) who are pulsed at a frequency which is considerably higher than the modulation-frequency.

23. Device for "mode-shift" according to claim 7, c h a r a c t e r i z e d b y that the road imidiatly before the position (43) where the vehicle enters the

rail (2), is equipped with a number of rolls (44 and 45) with mainly horizontal axis.

24. Device for "mode-shift" according to claim 23, c h a r a c t e r i z e d b y that at least one of the rolls (44) are conical and rotates in such a way that the upper part of the roll moves towards the rail (2).

25. Device for "mode-shift" according to claim 24, c h a r a c t e r i z e d b y that two further rolls (45) are placed in such a way that their axis (112) are parallel with the intersection-line (113) of one of the conical rolls with the roadplane and such that the distance between this intersection-line (113) and the intersection-line (114) between the roll and the roadplane away from the rail (2) equals the wheeldistance of the vehicle.

26. Device for "mode-shift" according to claim 7, c h a r a c t e r i z e d b y that the vehicle is equipped with a stribe of iron-plate (56) along both sides and that this stribe can be held by one or more magnetic holding-mechanismes (53) placed in a side-guidance-system (49) along the road (48) in a switch-place (50).

27. Device for "mode-shift" according to claim 26, c h a r a c t e r i z e d b y that the holding-mechanismes (53) are placed behind a rolling band (57) moving in the same height as the iron-plate (56).

28. Device for "mode-shift" according to claim 27, c h a r a c t e r i z e d b y that the holding-mechanismes (53) consists of rolls with vertical axis.

29. Device for "mode-shift" according to claim 28, c h a r a c t e r i z e d b y that the holding-mechanismes (53) are rolls of material which can be magnetized by means of a fixed current-coil (54).

30. Device for "mode-shift" according to claim 29, c h a r a c t e r i z e d b y that the rolls (53) consists of two horizontal disk-shaped rolls (55) connected to eachother via a tube-shaped axial piece (115) surrounded by the fixed current-coil (54).

31. Device for "mode-shift" according to claim 29 or 30, c h a r a c t e r i z e d b y that the current through the current-coil (54) is activated by one or more pulsating lightemitting diodes (51) placed on the side of the vehicle (1).

32. Device for "mode-shift" according to one or more of the claims 26 to 31 c h a r a c t e r i z e d b y that two or more horizontal rolls (60) activated from the vehicle (1) ensures that the vehicle makes a safe contact with the side-guidance-system (49) in the correct side.

33. Device for "mode-shift" according to claim 7, c h a r a c t e r i z e d b y that some time before two parallel rails (116 and 117) converts to road, the vehicles (118, 119 and 120) are syncronized in such a way that two vehicles never arrives to the position of rail-to-road convertion at the same time.

34. Device for "mode-shift" according to claim 33, c h a r a c t e r i z e d b y that the syncronization takes place by means of the current-rails (21).

35. Device for "mode-shift" according to claim 34, c h a r a c t e r i z e d b y that at least one of the current-rails (21) in every rail is divided into segments (61) who are supplied individual with current.

36. Device for "mode-shift" according to claim 35, c h a r a c t e r i z e d b y that the current supply for the segments (61) is organized in adjoining groups (62) who are shifted sequentially and separated by a larger adjoining group (63) of segments without current.

37 Device for "mode-shift" according to claim 36, c h a r a c t e r i z e d b y that the adjoining current-segment-groups (62) always is placed closest to the middle of the segment group (63) without current on the parallel rail.

38. Device for "mode-shift" according to claim 37, c h a r a c t e r i z e d b y that the current-segment-group (62) is supplied such that the voltage on the individual segments (61) increases the further behind in the group (62) the segment is situated.

39. Device for "mode-shift" according to claim 35 to 38 c h a r a c t e r i z e d by, that the spacing (121) between the segments is oblique in relation to the direction of the current-rail.

40. Transportsystem according to claim 1 c h a r a c t e r i z e d b y that the vehicle is supplied with current via gliding contacts (22) who are multiple and that the current from each of the sets is added to the current from the others.

41. Current-supply-system according to claim 40 , c h a r a c t e r i z e d b y that the contribution from the sets increase the further forward they are situated in the direction of movement of the vehicle.

42. Current-supply-system according to claim 39, 40 or 41, c h a r a c t e r i z e d by, that the supply to the two current-rails (21) is balanced in relation to ground-potential.

43. Mode-shift-organ according to claim 35, 36, 37 or 38, c h a r a c t e r i z e d b y that the supply is based on alternate current, and that the switching is happening during the zero-crossings.

44. Electric vehicle to transportsystem according to claim 5, c h a r a c t e r i z e d b y that a part of the battery-capacity (66) is placed so that it can be displaced sideways compared to the longitudinal axis of the vehicle.

45. Electric vehicle according to claim 44 , c h a r a c t e r i z e d b y that the displacable battery-capacity (66) is mounted in springloaded forks (67) who can be turned around a horizontal axis (125) just above the central notch (10).

46. Electric vehicle according to claim 45 , c h a r a c t e r i z e d b y that the displacable battery-capacity (66) is divided into modules which can be moved individually.

47. Electric vehicle for transportsystem according to

claim 5, c h a r a c t e r i z e d b y that the batteries (4) are mounted in such a way that they can be changed by being lowered through the bottom (122) of the vehicle (1).

48. Electric vehicle according to claim 47, c h a r a c t e r i z e d by, that the batteries (4) are hanging in their own contactdevices (70).

49. Electric vehicle according to claim 48, c h a r a c t e r i z e d by, that the contactdevices (70) are shaped as two bars with an elliptical crosssection and who can be turned 90 degrees so that they fit tight into corresponding elliptical batteriholes (68) with metallic inner surfaces connected to one of the battery-poles.

50. Electric vehicle according to claim 49, c h a r a c t e r i z e d b y that the elliptical bars (70) at the bottom are supplied with an elliptical thickening (73) just able to pass the elliptical hole (68) of the battery in a certain turning-angle, while it in all other angles will be hindered in passing the battery-hole (68).

51. Electric vehicle according to claim 50, c h a r a c t e r i z e d b y that the two elliptical holes (68) of the battery have different dimensions and correspondingly that the two elliptical bars (70) also have different dimensions.

52. Transportsystem according to claim 5, c h a r a c t e r i z e d b y that the vehicles (1) can park quite close on a low parking-rail (80) where the batteries (4) are recharged.

53. Parkingsystem according to claim 52, c h a r a c t e r i z e d b y that only the places on the parking-rail (80) where a vehicle (1) is situated is supplied with current.

54. Transportsystem according to claim 1, c h a r a c t e r i z e d b y that the part of the electric vehicles (1) who are collectively owned can be opened by means of a magnetic card (123).

55. Transportsystem according to claim 54, c h a r a c t e r i z e d b y that the magnet-card (123) is a socalled "smart card" onto which a certain amount of money can be loaded before use.

56. Transportsystem according to claim 54, c h a r a c t e r i z e d b y that the magnetic card (123) is a part of a payment-system through which the payment for the use of the system is made at appropriate intervals.

57 Transportsystem according to claim 56, c h a r a c t e r i z e d b y that the paymentinformations are transferred from the vehicle (1) to the rail-system (2) imidiately before it leaves the rail.

58 Transportsystem according to claim 57, c h a r a c t e r i z e d b y that the informationtransfer is done by means of a barcode (82 and 83) placed in the longitudinally notch (10) of the vehicle where it can be read when the vehicle (1) passes a simple barcode-reader placed fixed in the side of the rail.

59. Transportsystem according to claim 58, c h a r a c t e r i z e d b y that the barcode is twofold such that the first part is a fixed barcode (82) identifying the vehicle (1) while the second barcode (83) is variable and controlled by the computer of the vehicle in such a way that it can be coded to contain data about how long distance the vehicle has been driving.

60. Transportsystem according to claim 59, c h a r a c t e r i z e d b y that the variable barcode (83) is built from a row of segments (84) with a width corresponding to the smallest possible bar in the barcodesystem.

61. Transportsystem according to claim 5, c h a r a c t e r i z e d b y that the vehicle is supplied with one or more wire-loops (85) which can exchange informations with the surroundings.

62 Transportsystem according to claim 61, c h a r a c t e r i z e d b y that the information consists of changing magnetic fields whose extension longitudinally creates a coded information about for example the geographical position of the place.

63. Transportsystem according to claim 62, c h a r a c t e r i z e d b y that the magnetfield is created by means of current through two parallel conducters (86) placed in the rail (2) and where the wire-crossings (124) determine the position of the shift of the direction of the magnetic field.

64. Transportsystem according to claim 61, c h a r a c t e r i z e d b y that there are two wire-loops (85) placed symmetrical around the midline of the vehicle.

65. Transportsystem according to claim 64, c h a r a c t e r i z e d b y that the two wire-loops (85) collects signals transmitted by a system of parallel conductors (87) buried in the road (48).

66. Transportsystem according to claim 65, c h a r a c t e r i z e d b y that the current in the parallel conductors (87) creates a field inducing voltages into the wire-loops (85) whose sum and/or difference indicates the position of the vehicle in relation to the parallel conductors.

67. Transportsystem according to claim 66, c h a r a c t e r i z e d b y that the calculated position-signal is used to control the turning of the front-wheels (41) of the vehicle (1).

68. Transportsystem according to claim 5, c h a r a c t e r i z e d b y that the surface of the rail is made superconductive by means of for example liquid nitrogen (99) filling up the inner room of the rail and that the whole system consisting of rail and vehicle is enclosed in a tube (96) which is evacuated.

69. Battery-contact-device according to claim 49, 50 or 51 c h a r a c t e r i z e d b y that connector-arrangments (70) are equipped with a number of oblong springloaded metal-blades who by turning creates electrical contact with the terminals (69).

70. Transportsystem according to claim 1 c h a r a c t e r i z e d b y that the vehicles are programmed to automatically perform the necessary switces between rails via road in order to be able to transport goods fully automatical.

71. Transportsystem according to claim 1 c h a r a c t e r i z e d b y that the units are coupled to form a row of driverless passenger-cabins driving between fixed stations.

72. Transportsystem according to claim 71 c h a r a c t e r i z e d b y that the length of the row corresponds to the number of passengers.

73. Transportsystem according to claim 71 c h a r a c t e r i z e d b y that the row is composed in a certain sequence such that the passengers heading for the next station are always placed in the back of the row.

74. Transportsystem according to claim 1 c h a r a c t e r i z e d b y that the units can be coupled together and separated while they move.

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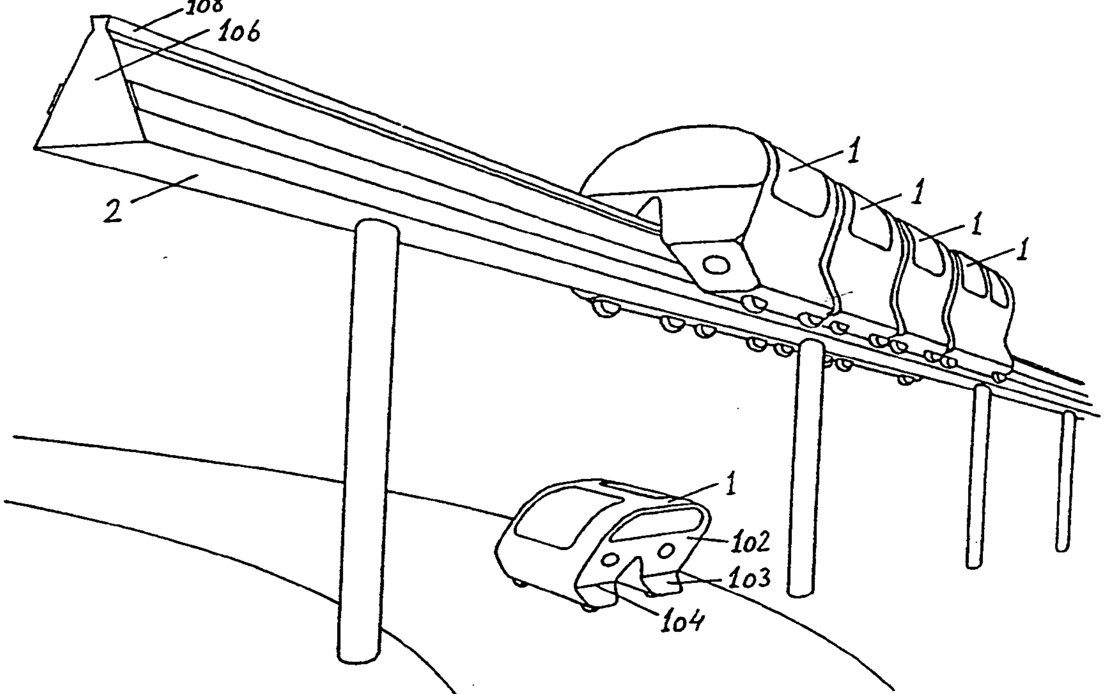

Fig. 1

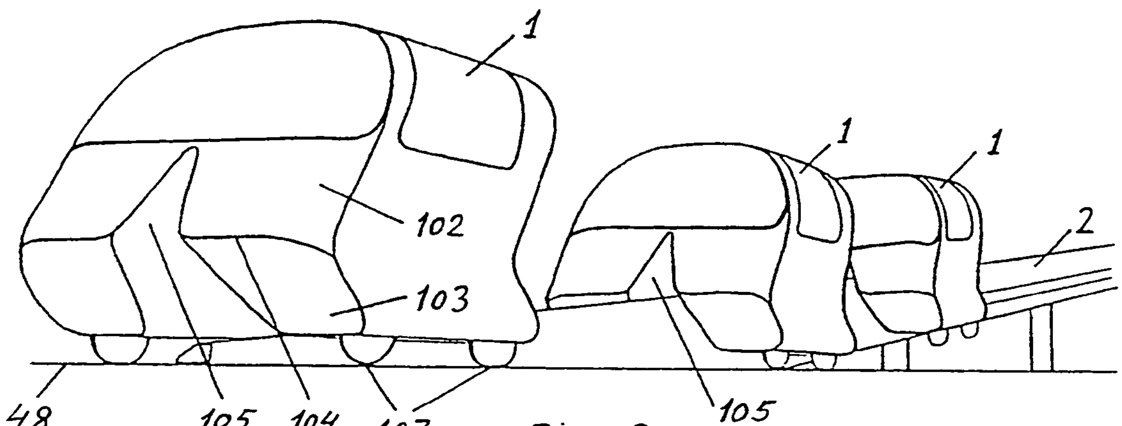

Fig. 2

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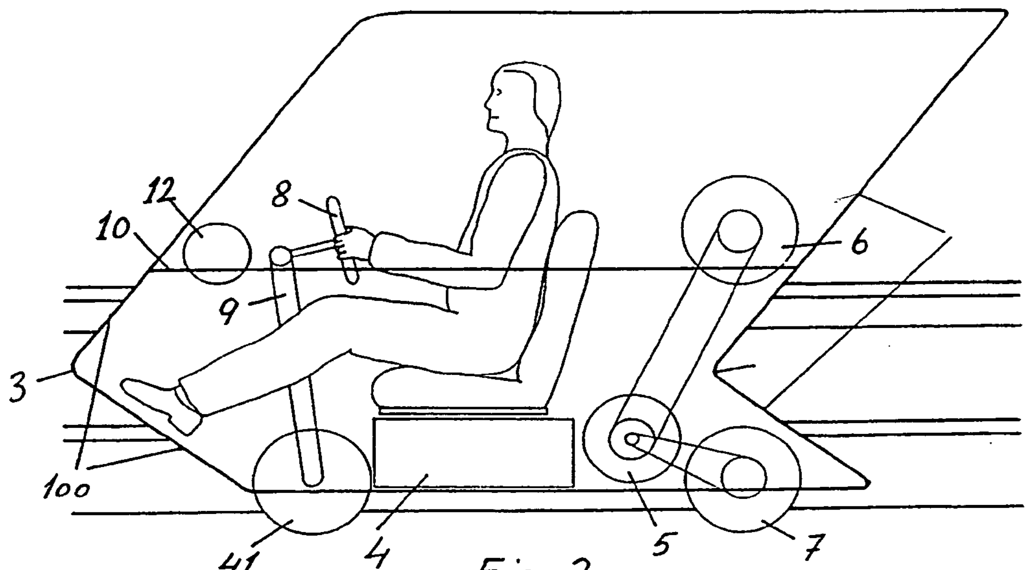

Fig. 3

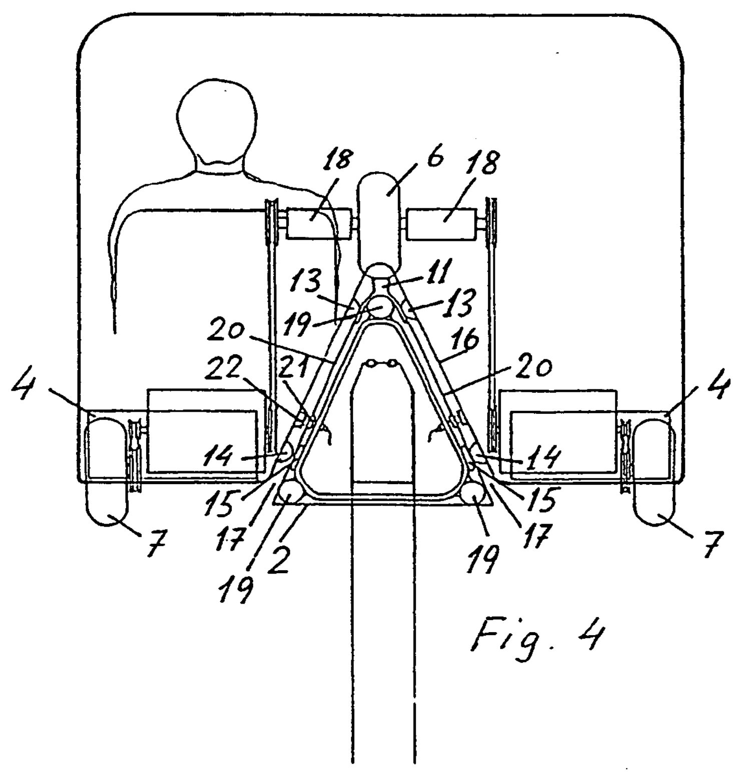

Fig. 4

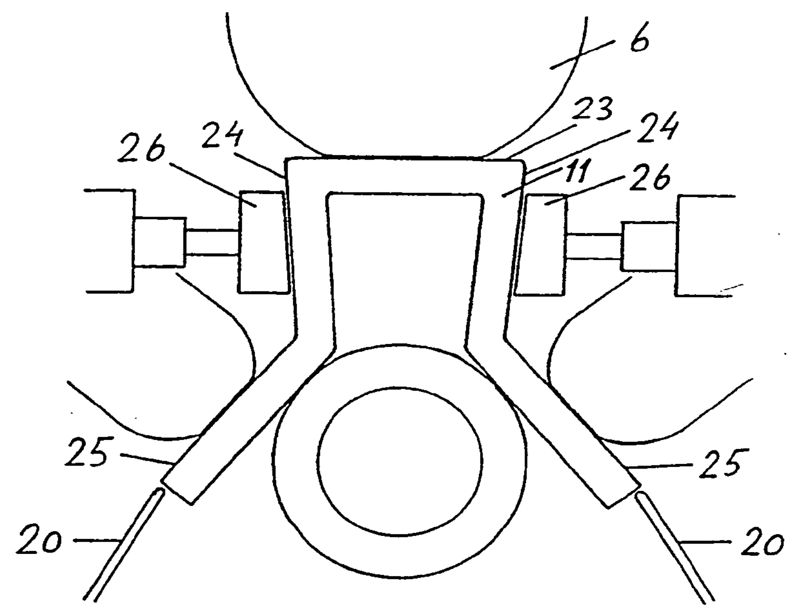

Fig. 5

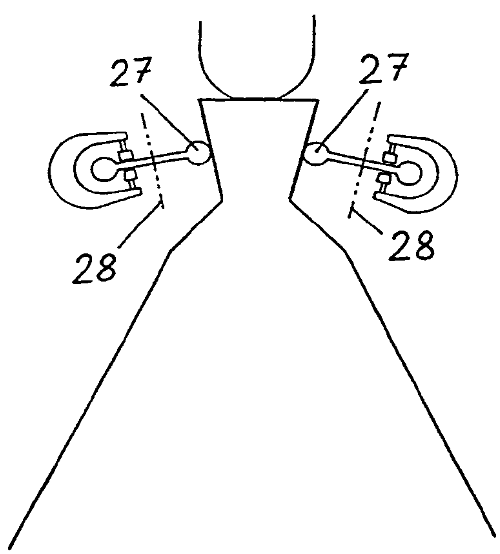

Fig. 6

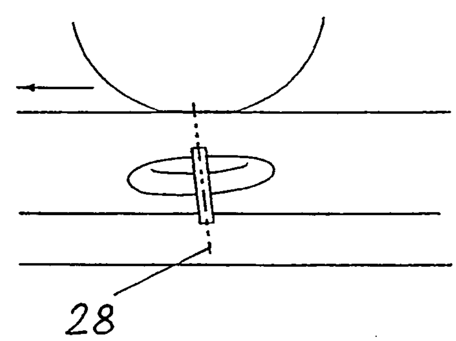

Fig. 7

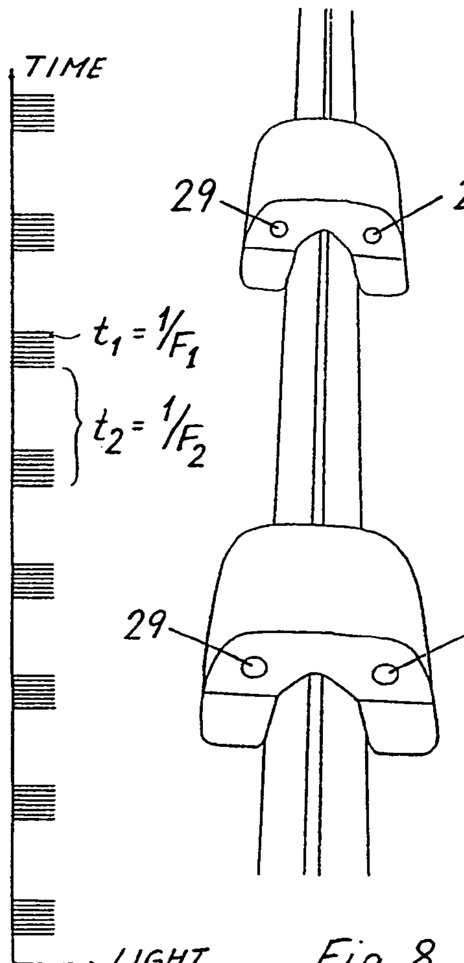

Fig. 8

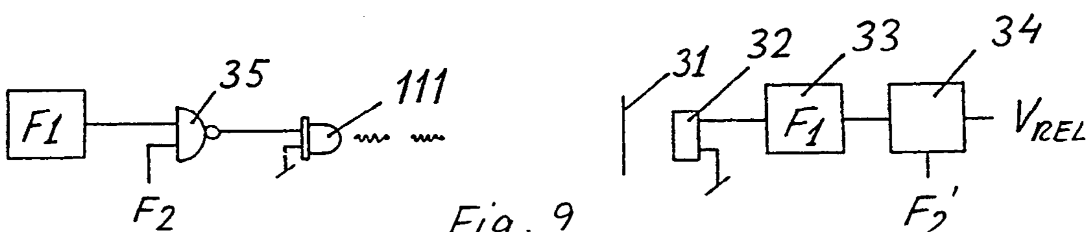

Fig. 9

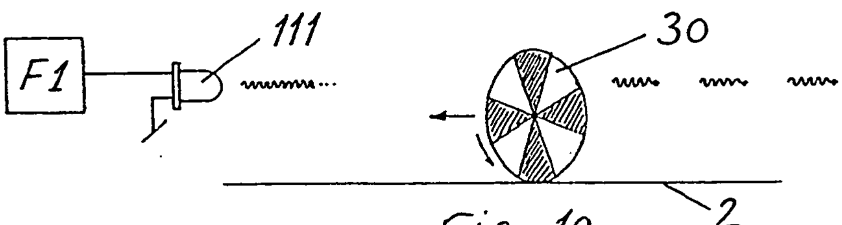

Fig. 10

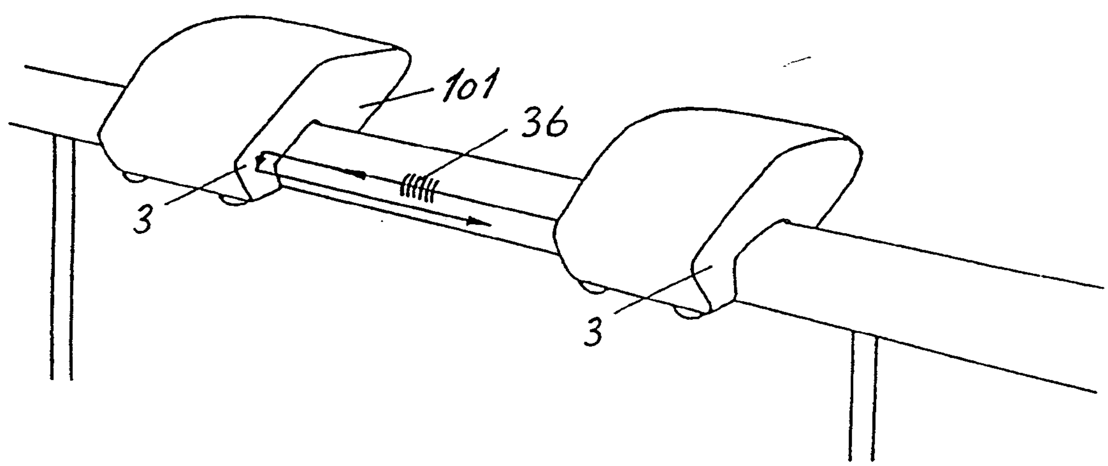

Fig. 11

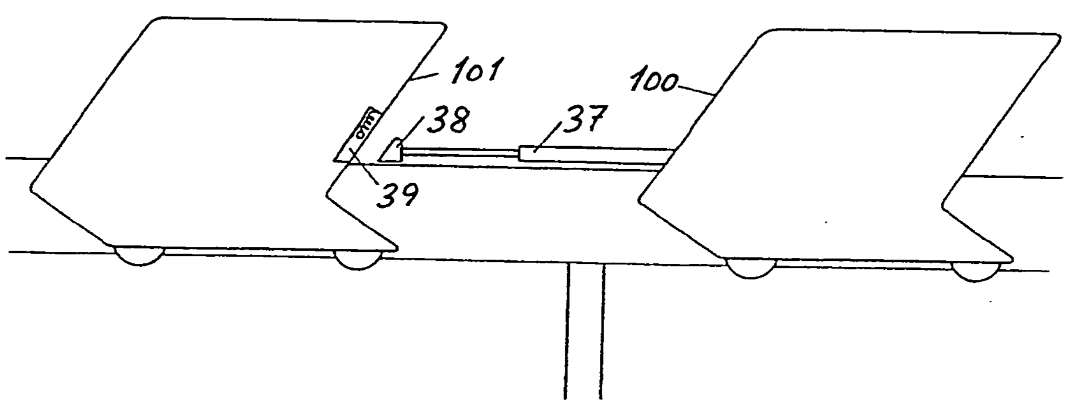

Fig. 12.

Fig. 13

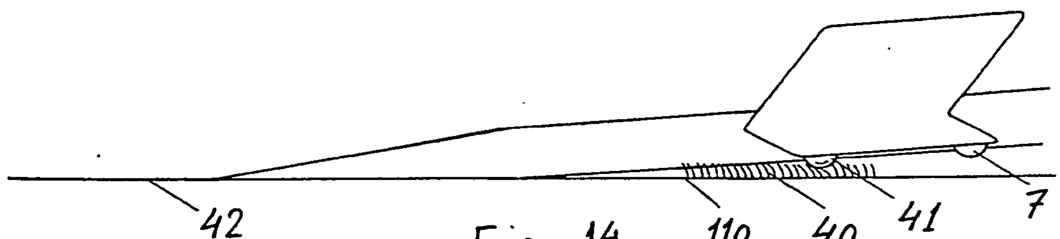

Fig. 14

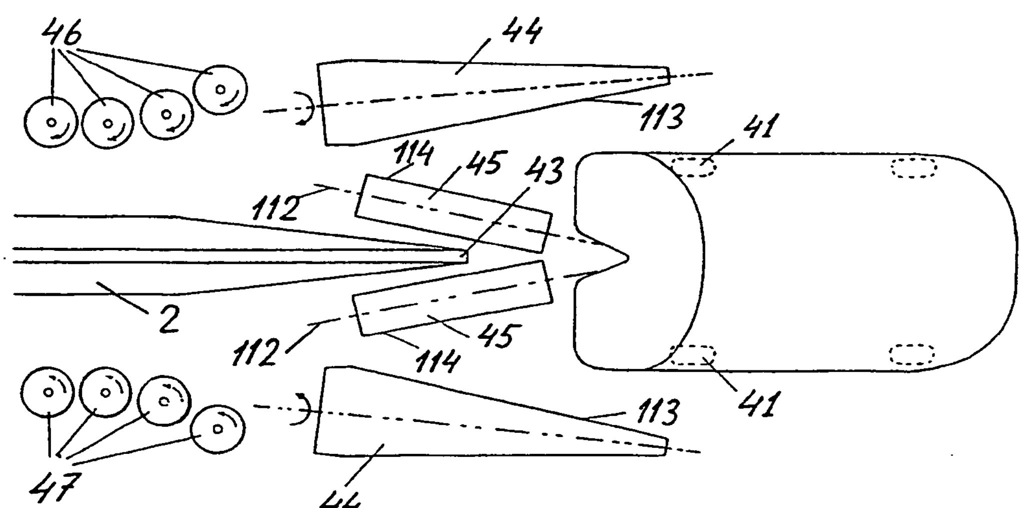

Fig. 15

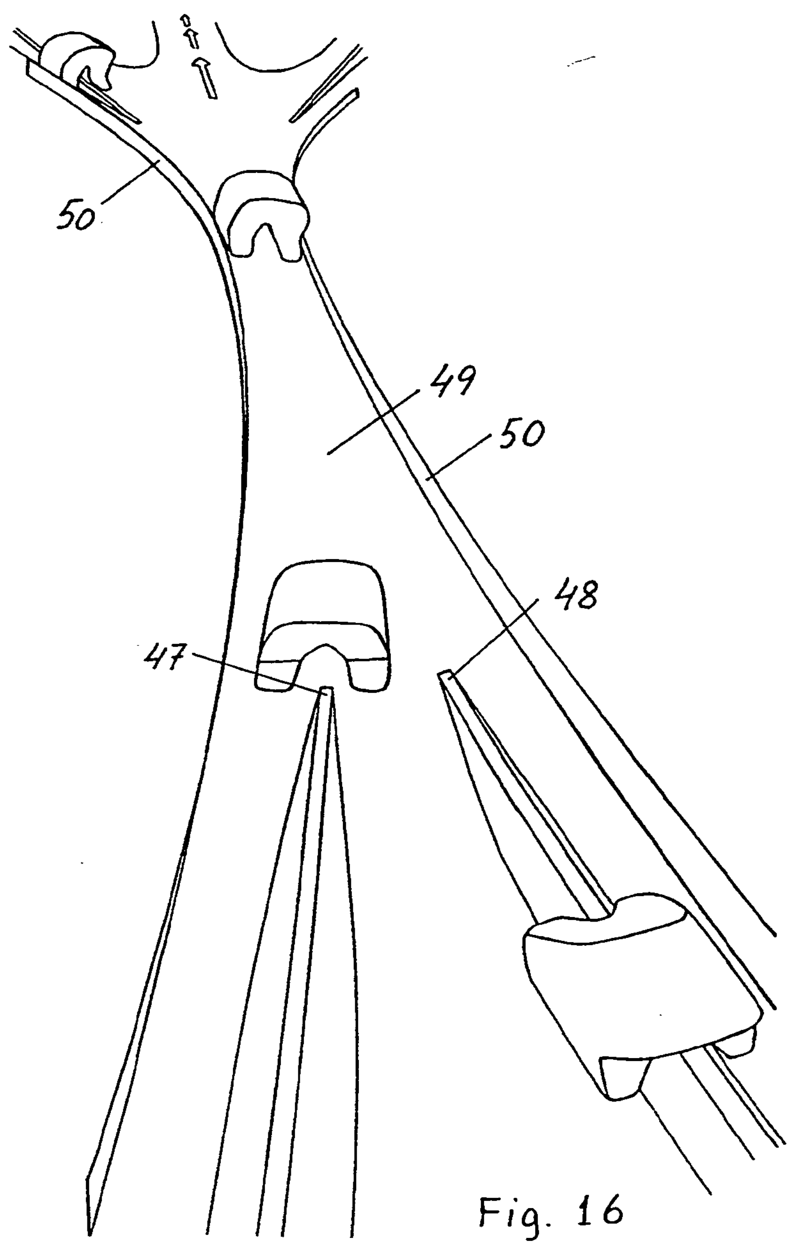

Fig. 16

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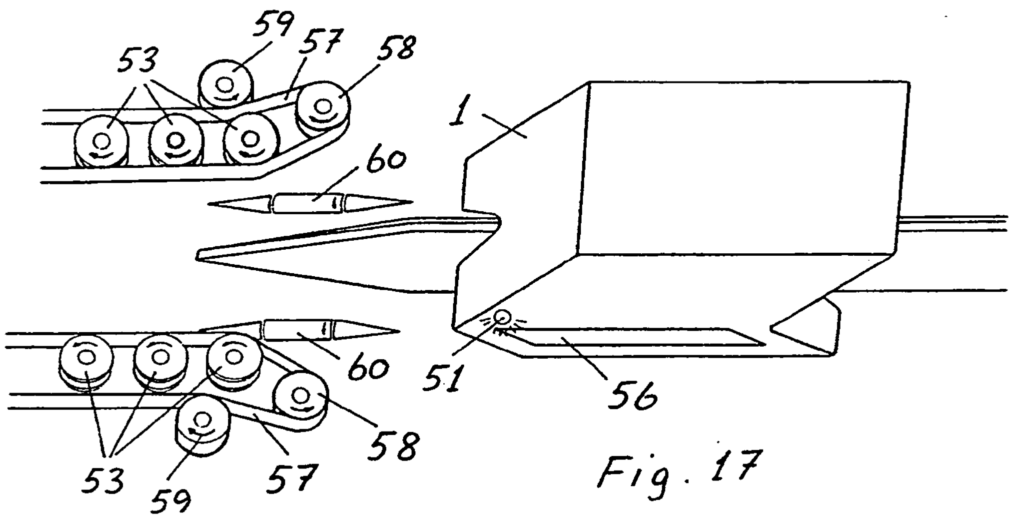

Fig. 17

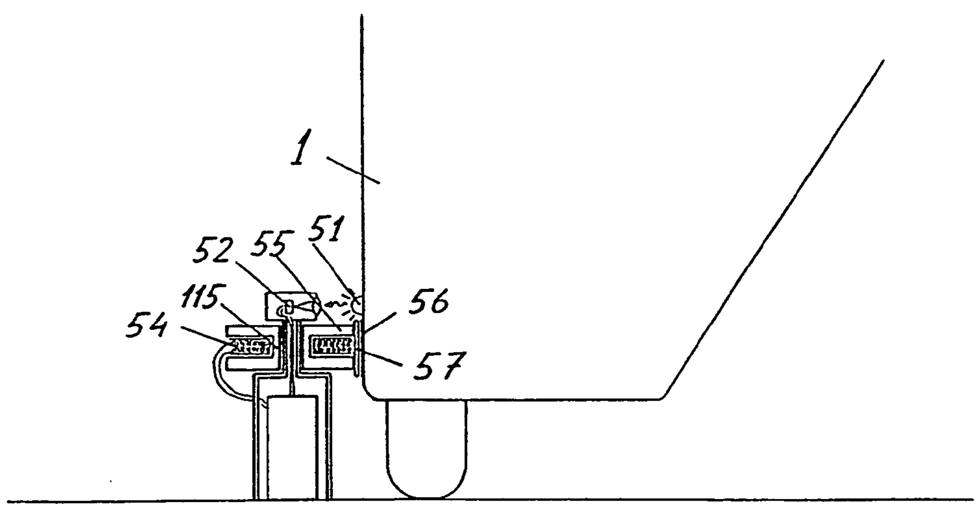

Fig. 18

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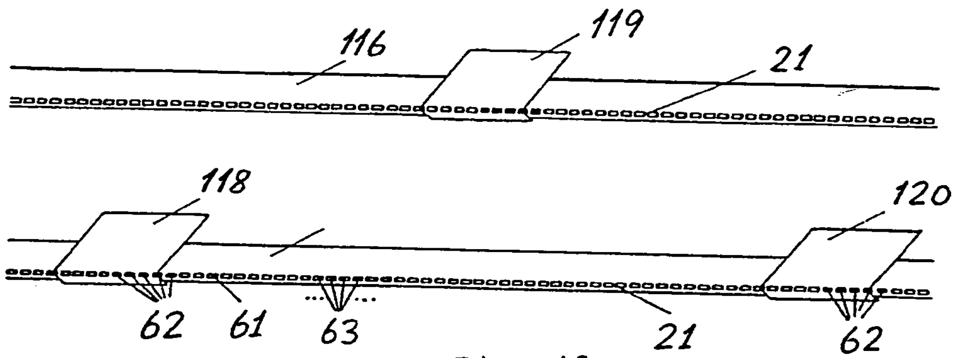


Fig. 19

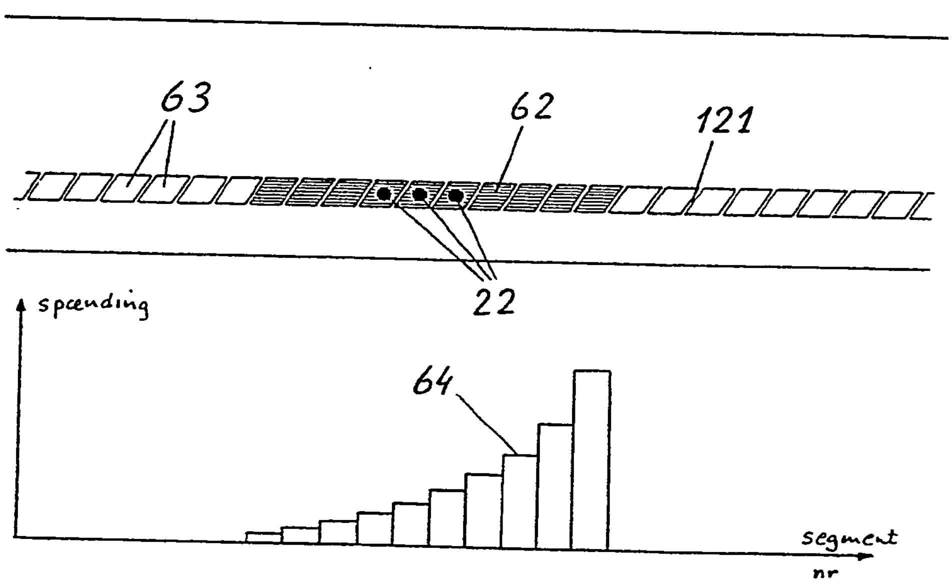


Fig. 20

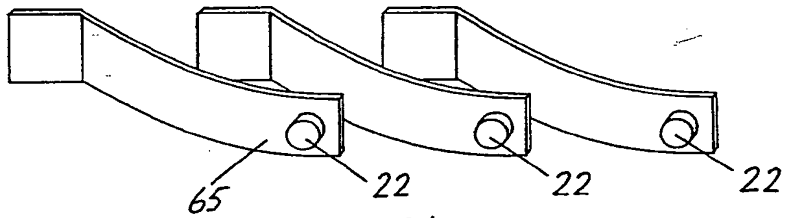


Fig. 21

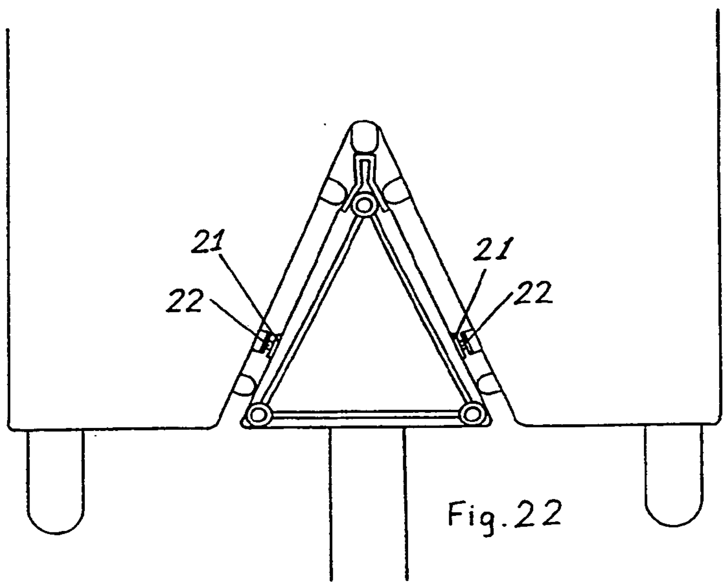


Fig. 22

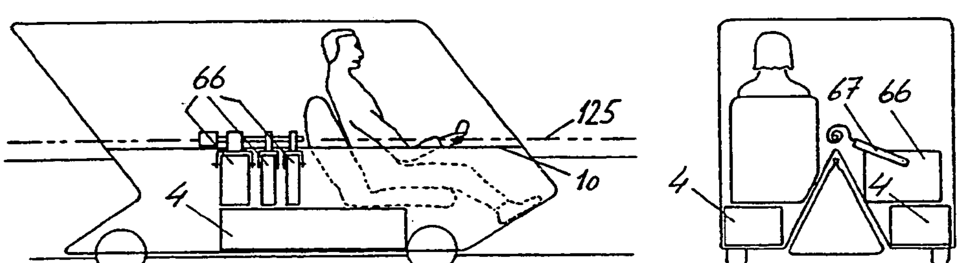


Fig. 23

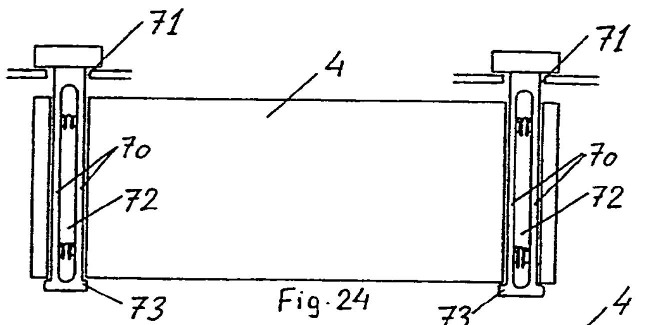


Fig. 24

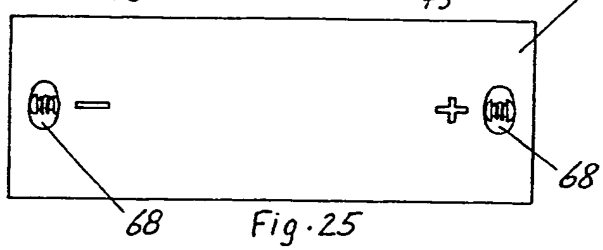


Fig. 25

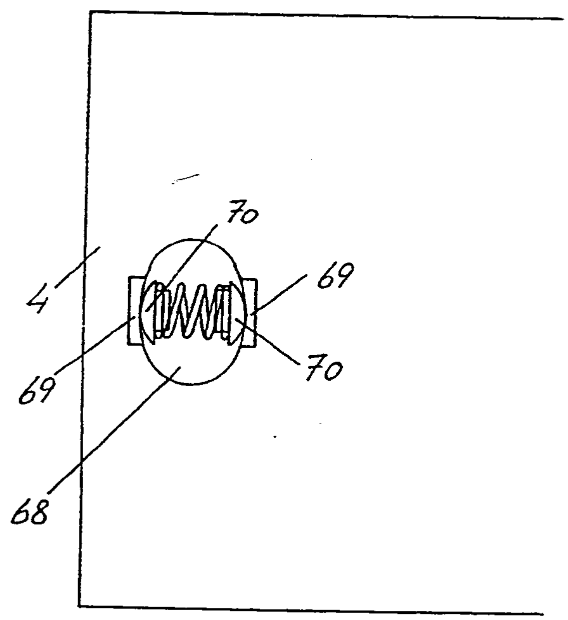


Fig. 26

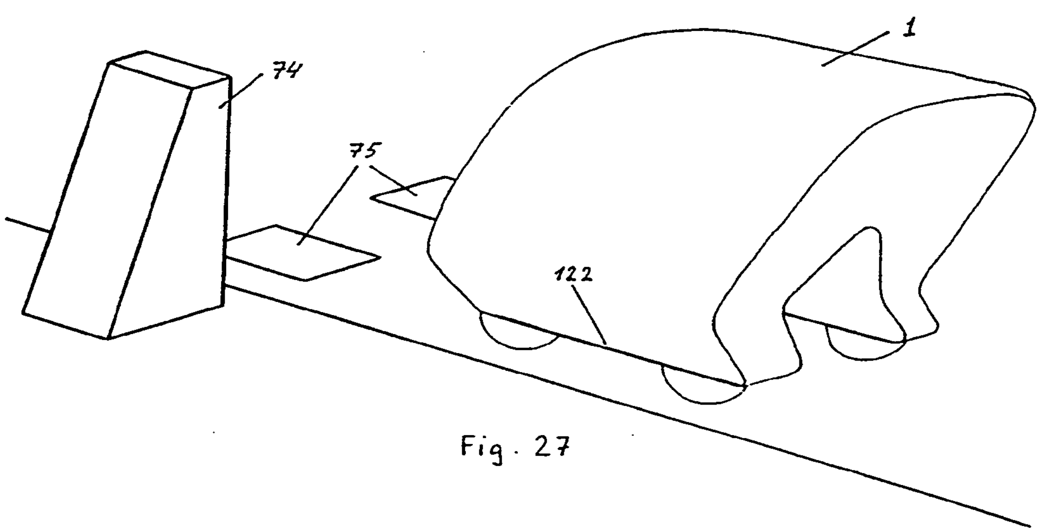


Fig. 27

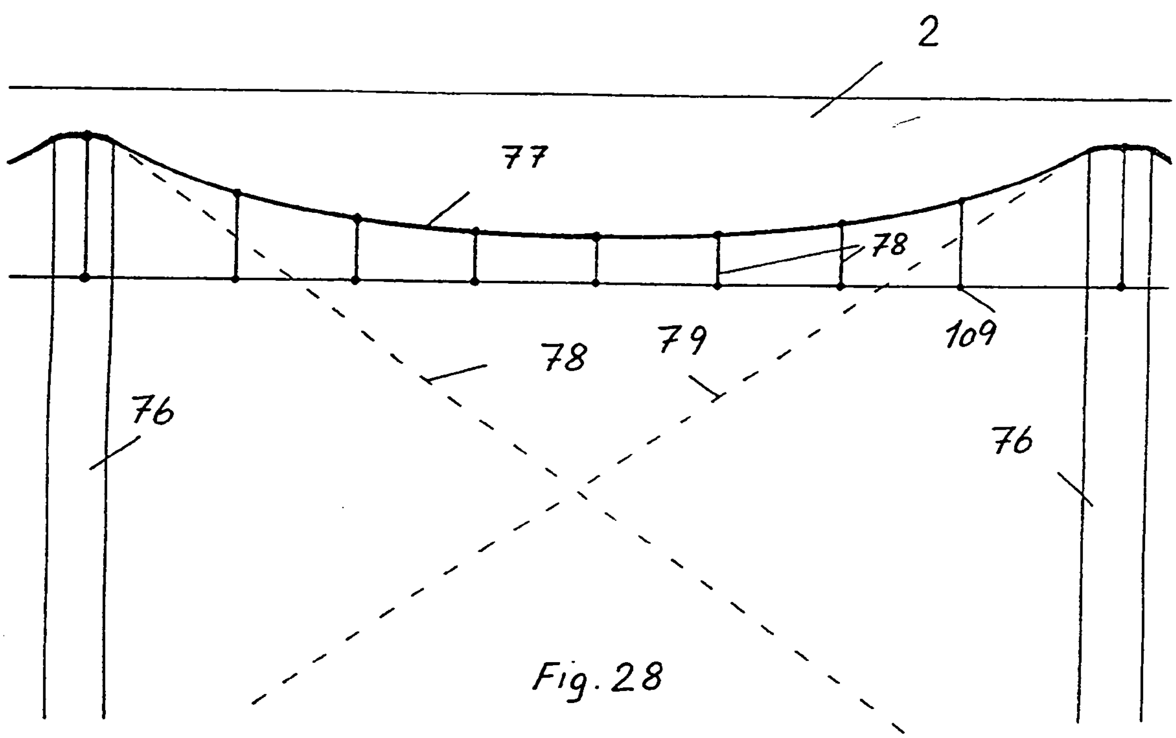


Fig. 28

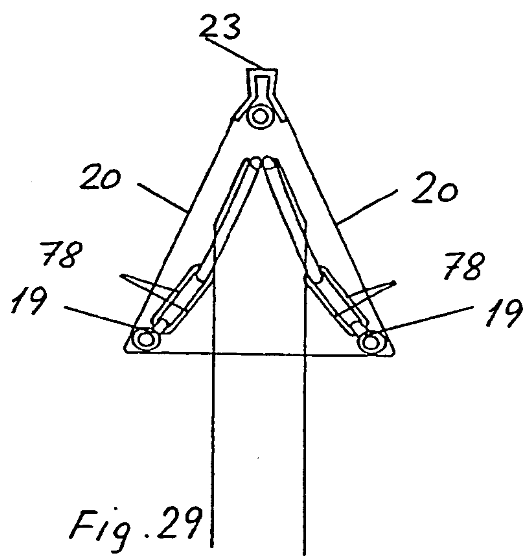


Fig. 29

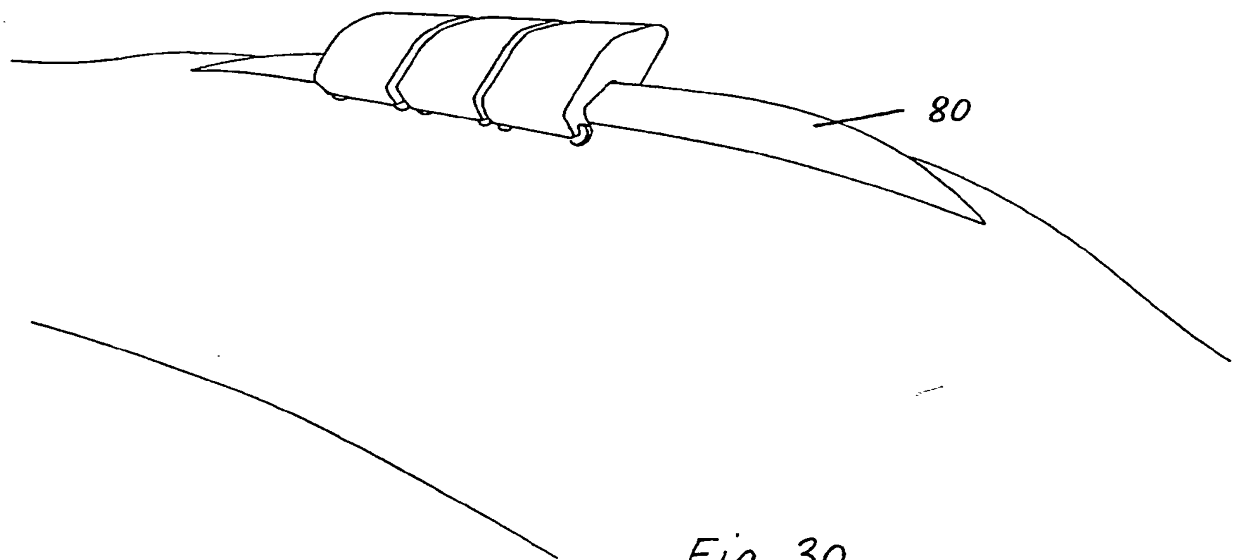


Fig. 30

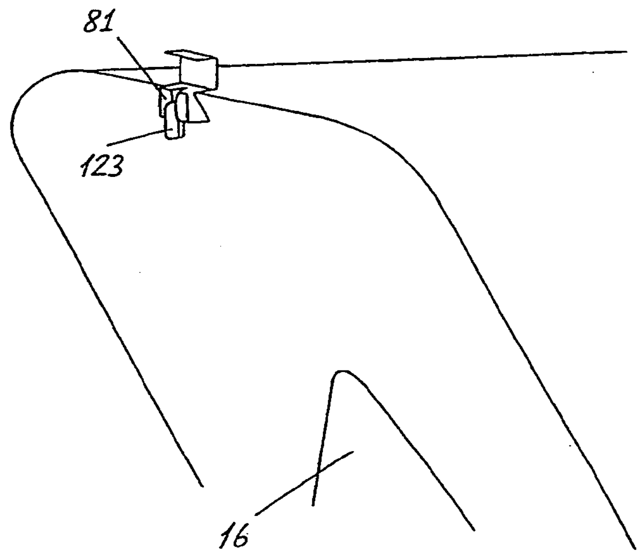


Fig. 31

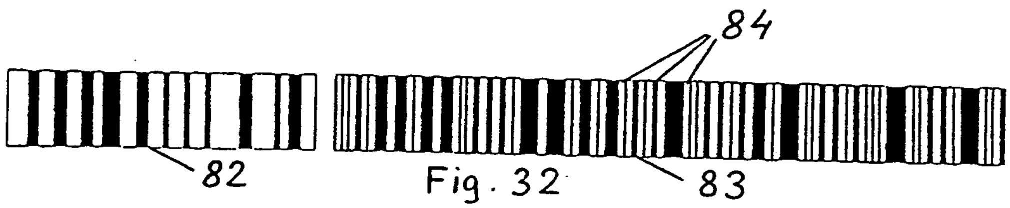


Fig. 32

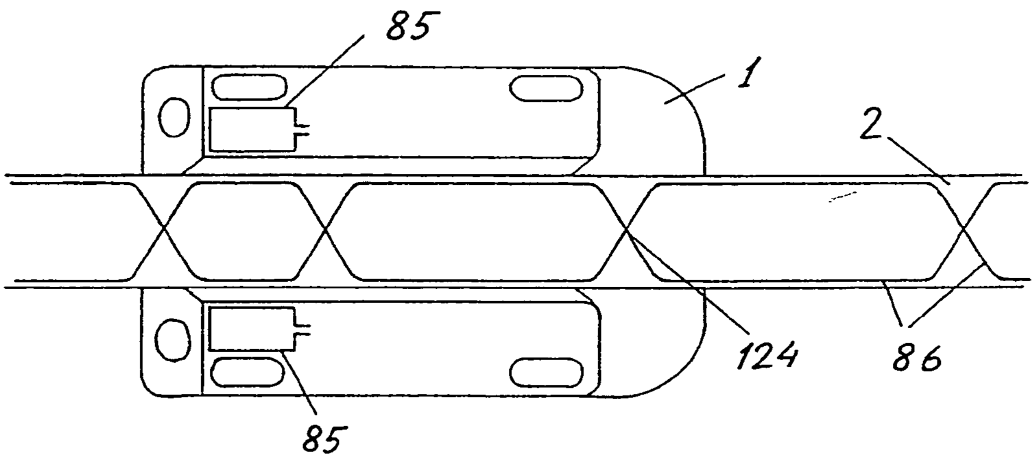


Fig. 33

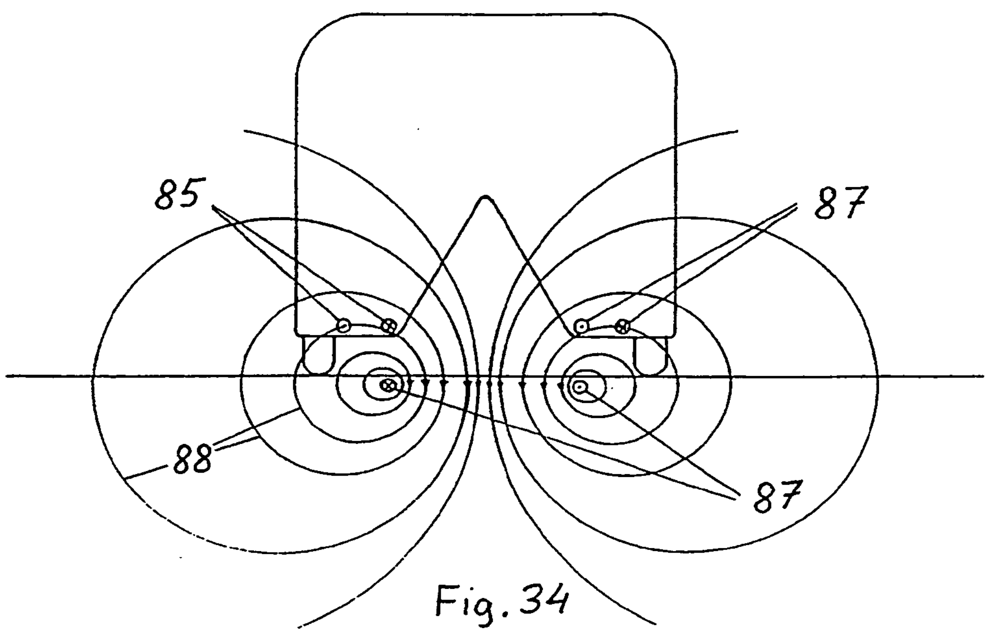
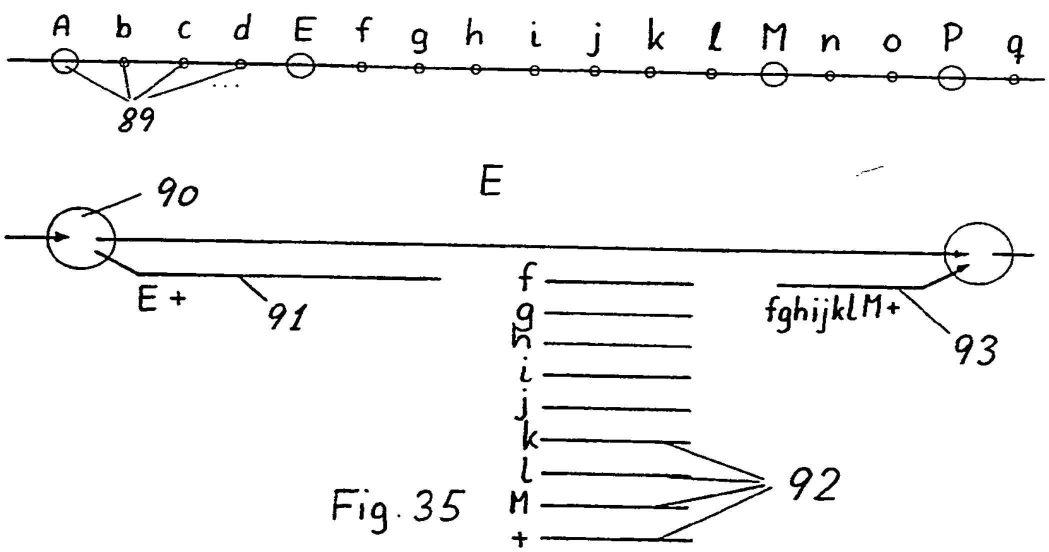


Fig. 34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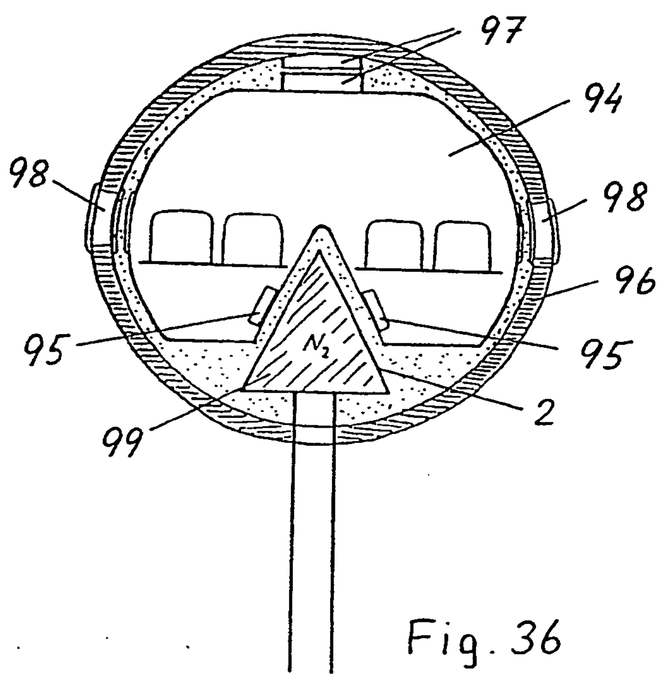
E
E +
91
f
g
h
i
j
k
l
M
+
92
fghijklM+
93

Fig. 35


97
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98
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96
95
95
N_2
2
99

Fig. 36

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 91/00146

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 61 B 13/00, B 60 F 1/00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 61 B, B 60 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X Y	US, A, 3225704 (M GILVAR) 28 December 1965, see column 4, line 59 - line 64; figure 1 --	1 5-7
Y	US, A, 3447481 (H F GORMAN) 3 June 1969, see figures 5,9 --	5-7
X	DE, A, 2622778 (DAIMLER BENZ AB) 1 December 1977, see page 19, line 4 - line 9; figures 9a,9b --	1-2
X	DE, A, 2744405 (DAIMLER BENZ AB) 12 April 1979, see page 12, line 1 - line 8; figures 1-3 --	1-2

* Special categories of cited documents:[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
28th October 1991	1991 -10- 28
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Kenneth Gustafsson

Form PCT/ISA/210 (second sheet) (January 1985)

OCID: <WO 9118777A1 I >

International Application No. PCT/DK 91/00146

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	GB, A, 1455817 (GEC-ELLIOTT AUTOMATION) 14 January 1974, see the whole document --	1-4

Form PCT/ISA/210 (extra sheet) (January 1985)

International Application No. PCT/DK 91/00146

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. [X] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. [ ] Claim numbers..........., because they relate to subject matter not required to be searched by this Authority, namely:

2. [ ] Claim numbers..........., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claim numbers..........., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. [X] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

See further information continued

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. [X] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the the claims. It is covered by claim numbers:

   1-13,19-29,23-39,43-53,65-69

4. [ ] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

[ ] The additional search fees were accompanied by applicant's protest.

[ ] No protest accompanied the payment of additional seach fees.

FURTHER INFORMATION C NTINUED

Without support from the main claim 1, the invention according to the dependent claims listed below, do not pertain to a single general inventive concept.

Claims 1, 14-18, relate to a connection between the vehicles.

Claims 1, 21-22, relate to a steering system for the vehicles.

Claims 1, 40-42, relate to the electric propulsion of the vehicles

Claims 1, 54-64. relate. to a magnetic card for the vehicles.

Claims 1, 70, relate to vehicles for transporting of loads.

Claims 1, 71-73, relate to driverless passenger cabins.

Claims 1, 74, relate. to a coupling device between vehicles.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/DK 91/00146

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 91-09-27
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3225704	65-12-28	NONE	
US-A- 3447481	69-06-03	NONE	
DE-A- 2622778	77-12-01	FR-A-B- 2351836	77-12-16
		GB-A- 1580374	80-12-03
		JP-A- 52143608	77-11-30
		US-A- 4596192	86-06-24
DE-A- 2744405	79-04-12	FR-A-B- 2404543	79-04-27
GB-A- 1455817	74-01-14	NONE	